Table (2): Combined correlation coefficient of LY/P and LY components for four Egyptian and two Upland cotto nvarieties, 1981 and 1982 seasons.

Character	Ly/P	B/P	S/B	L/S	F/S	ML	Mic	
	*	0.9822**	0.2344**	0.2488**	0.0820	0.1156*	0.1251*	Ly/P
B/P	0.9369**	*	-0.0721	-0.0158	-0.0180	-0.0107	-0.0052	B/P
S/B	0.2274**	0.0400	*	0.0167	-0.0442	0.0057	0.0694	S/B
L/S	0.2322**	0.034	-0.0030	*	------	0.3188**	0.4219**	L/S
F/S	0.1094	0.0746*	0.1712**	------	*	-0.0044	-0.0899**	F/S
ML	0.0452	0.0310	-0.0412	0.4379**	0.2377	*	0.1828**	ML
Mic	0.1327	0.0089	0.2414**	0.3646**	0.5153*	0.0798*	*	Mic.

Above diagnoal coefficients are for Egyptian varieties and below diagnoal are for Upland cotton varieties.

*, **: Significant at the 5% and 1% respectively.

Table (3): Partioning of simple correlation coeffecients of lint yield and its components for four Egyptian and two Upland cotton varieties.

Sources	Model I(a)		Model I(b)	
	Egyptian	Upland	Egyptian	Upland
1- Number of bolls vs. lint yield				
Direct effect (PY_1)	0.8872	0.8524	0.9364	0.9335
Indirect via S/B	0.0303	0.0264	-0.0106	-0.0214
via L/S	0.0379	0.0662	-0.0011	-0.0048
Total (ry_1)	0.9554	0.9450	0.9369	0.9022
2- Seed/boll vs. lint yield				
Direct effect (Py_2)	0.2420	0.2345	0.2654	0.2970
Indirect via B/m^2	0.1110	0.0959	-0.0375	-0.0000
via L/S	0.0174	0.0500	-0.0005	-0.0044
Total (ry_2)	0.3704	0.3804	0.2274	0.2344
3- Lint/seed vs. lint yield				
Direct effect (Py_3)	0.1766	0.2481	0.1746	0.2610
Indirect via B/m^2	0.1903	0.2274	0.0594	0.0172
via S/B	0.0239	0.0483	-0.0008	0.0052
Total (ry_3)	0.3908	0.5228	0.2332	0.2488

Model I(a) Ly/m= $B/m^2 \times S/B \times L/S$
Model I(b) L/= $B/P \times S/B \times L/S$

Table (4): Partitioning of simple correlation coefficients of lint yield (LY) and LY components for four Egyptian and two Upland cultivars.

Source		Model II(a)			Model II(b)	
		B/m^2 vs. LY/m^2			B/P vs. LY/P	
		Egyptian	Upland		Egyptian	Upland
Direct effect (PYL)		0.9071	0.8570		0.9380	0.9287
Indirect via;	S/B	0.0287	0.0230		-0.0102	-0.0220
	F/S	0.0136	0.0272		0.0116	-0.0022
	ML	0.0018	0.0017		-0.0011	-0.0013
	Mic	0.0078	0.0361		-0.0014	-0.0001
Total (ry)		**0.9554**	**0.9450**		**0.9365**	**0.9022**
		S/B vs. LY/m^2			S/B vs. LY/P	
Direct effect (PY2)		0.2297	0.2044		0.2552	0.3050
Indirect via;	B/m^2	0.1135	0.0964	B/P	-0.0375	-0.0669
	F/S	-0.0154	0.0507	F/S	-0.0266	-0.0054
	ML	0.0029	0.0007	ML.	-0.0015	0.0007
	Mic.	0.0397	0.0283	Mic.	0.0378	0.0010
Total (ry)		**0.3904**	**0.3804**		**0.2274**	**0.2344**
		F/S vs. LY/m^2				
Direct effect (PY3)		0.0633	0.2423		0.1554	0.1214
Indirect via	B/m^2	0.1947	0.0961	B/P	0.0700	-0.0167
	S/B	-0.0561	0.0428	S/B	-0.0437	-0.0135
	ML.	-0.0134	-0.0051	ML.	0.0084	-0.0005
	Mic.	-0.0442	-0.1048	Mic.	-0.0807	-0.0087
Total		**0.1462**	**0.2713**		**0.1094**	**0.0830**
		ML. vs. LY/m^2				
Direct effect (PY)		0.0339	0.0103		0.0354	0.1216
Indirect via;	B/m	-0.0489	0.1374	B/P	-0.0291	-0.0099
	S/B	0.0194	0.0137	S/B	-0.0150	0.0017
	F/S	-0.0251	-0.1197	F/S	0.0369	-0.0005
	Mic	-0.0105	-0.0028	Mic.	0.0125	0.0027
Total		**0.1462**	**0.0445**		**0.1094**	**0.1156**
		Mic. vs. LY/m^2				
Direct effect (PY)		0.0932	0.2[illegible]7		0.1567	0.0148
Indirect via;	B/m	0.0759	0.1[illegible]55	B/P	-0.0083	-0.0048
	S/B	0.0979	0.0271	S/B	0.0616	0.0212
	F/S	0.0286	-0.1193	F/S	-0.0801	0.0716
	ML.	0.0038	0.0001	ML.	0.0028	0.0222
Total		**0.2422**	**0.2127**		**0.1327**	**0.1250**

The results obtained did not vary from those previously reported by Manning (1958); Kerr (1966); Worley et al., (1974); El-Shaer et al., (1975); El-Marakby et al., (1980) and Abd El-Rahman (1983).

The relative contribution of various lint components to lint yield with reference to Model II(a) for both cotton groups is shown in Table (5). By a cursory look, one could detect that most of the variation in LY/m^2 came from B/m^2. Other lint components, namely, S/B, F/S, ML and Mic contributed relatively small and inconsistently as direct effects to LY. The small contribution of S/B, F/S, ML and Mic is due as a matter of fact to that lint per boll, (a macro-component of lint yield), is limitted by and large by those variables. To explain, an increase in F/S was almost offset by a decrease of either ML, Mic or both, or so to speak. Moreover, S/B was almost negatively correlated with L/S and F/S. The joint effects were also minimal (Table 6).

With reference to Model II(b) Table, 5 it is clear that the major contribution to LY/P came from B/P in both cotton groups. Again the joint effects and the residual are trivial.

In summary, the main sources of LY variation could be arranged as to their relative importance in both Model I(a) and Model I(b) as follows; B/m^2 and/or B/P and L/S and the joint effect of B/m^2 or B/P with L/S. Whereas in both II(a) and II(b) models, B/m^2 and/or B/P, S/B and ML were the main sources of variation in the same order. Their joint effect though inconsistant and of trivial magnitude, yet they could be arranged as follows: B/m^2 or B/P through S/B F/S and Mic; S/B through Mic or F/S through Mic., however in a negative direction.

Breeding implication:

The results of this study could be put in terms of applicability as such: the major component of lint yield according to the models is either B/m^2 or B/P. The boll, the macro-biological unit contributing to yield could be broken down into a series of smaller units. Of these units, L/S is highly important. This latter is a function of F/s, Ml, and Mic. The latter two have relatively narrow range of acceptability in the textile industry. Naturally, efforts are exerted to preserve these components at their present level. Hencefor[illegible], the only mean to increase lint yield is through F/S. As is previously mentioned, increasing F/s would elici[illegible] certain difficulties. The only way around

Table (5): Direct and joint effect of characters contributing to lint yield/plant or /boll in four Egyptian and two Upland cotton cultivars.

Source	Model I(a).		Model II(a).	
	R^2		R^2	
Number of bolls	0.7871	0.7266	0.8768	0.8619
S/B	0.0586	0.0550	0.0704	0.0882
L/S	0.0312	0.0616	0.0305	0.0681
B x S/B	0.0538	0.0450	-0.0199	-0.0397
B x L/S	0.0672	0.1128	0.0008	-0.0089
S/B x L/S	0.0084	0.0234	-0.0003	0.0026
Residual	-0.0063	-0.0244	0.0217	0.0278
Total	1.0000	1.0000	1.0000	1.0000

R: Coefficient of determination.

Table (6): Direct and joint effect of characters contributing to lint yield in four Egyptian and two Upland cotton cultivars.

Source	Model I(a).		Model II(a).	
	R^2		R^2	
Number of boll	0.8228	0.7344	0.8798	0.8608
S/B	0.0528	0.0418	0.0651	0.0930
F/S	0.0040	0.0587	0.0241	0.0147
ML.	0.0011	0.0001	000013	0.0148
Mic.	0.0087	0.0452	0.0246	0.0002
B/ x S/B	0.0521	0.0394	-0.0191	-0.0408
B/ x F/S	0.0247	ῦ0.0466	0.0218	-0.0041
B/ x ML	-0.0033	0.0029	-0.0021	-0.0002
		0.0619	-0.0026	-0.0002
B/ x Mic.	0.0142	0.0207	-0.0136	-0.0033
S/B x F/S	-0.0071	0.0003	-0.0008	0.0004
S/B x ML	0.0013	0.0I14	0.0193	0.0006
S/B x Mic	0.01[illegible]2	-0.0025	0.0026	-0.0001
F/S x ML	-0.00[illegible]7	-0.0508	0.0251	-0.0021
F/S x Mic	0.00[illegible]3	0.0001	0.0009	-0.0007
Ml. x Mic	0.0[illegible]7	-0.0102		
Residual	0.0168	-0.0102	0.0238	0.0678
Total	1.0000	1.0000	1.0000	1.0000

R: Coefficient of determination.

is to select for the proflicacy of B/m², or B/P together with some effort to preserve the status quo of ML and Mic.

REFERENCES

Abd El-Rahman, L.M.A. (1983): Studies on fiber and development of cotton with special reference to fibers and grading quality. Ph.D. Thesis, Fac. Agric., Cairo Univ., Egypt.

Bridge, R.R.; Meredith, W.R. and Chism, J.F. (1971): The influence of planting date on agronomic and fiber properties of cotton. Bull. Agric and forestery Ex. Sta., Miss.

El-Marakby, M.M.; El-Moghazy, M.E.M.; Abo-Alam, A.M. and Al-Khafajy, S.M. (1980): Path coefficient analysis and response to selection for yield and its components in Egyptian cotton varieties. Agric. Res. Rev., 58(9): 417-435.

El-Shaer, M.H.; El-Sorady, A.S. and Sammra, A.M. (1975): Geometrical yield model for different crop densities of Ashmouni cotton cultivar (G. barbadense). Z.Acker und Pflanzenbau, 141: 102-108.

Kerr, T. (1966): Yield components in cotton and their interrelationship with fiber quality. Proc. 18th. Cotton Improvement Conf., P. 276-287.

Maner B.A.; Worley, L.S.; Harrell, D.C. and Culp, T.W. (1971): A geometrical approach to yield models in Upland cotton (G. hirsutum) Crop Sci., 11: 904-906.

Manning, H.G. (1958): Yield improvement from a selection index technique with cotton. Heredity, 10: 303-322.

Waldin, R.S.; Jatasra, D.S. and Dahiya, B.N. Hārgan (1979): Correlation and path analysis of yield ocmponents in G. arboreum. Indian, J. of Agric. Sci. 49(1): 32-43.

Worley, S., Jr.; Ramey, H.H., Jr.; Hareell, D.C. and Culp, T.W. (1976): Ontogenetic model of cotton yield. Crop Sic., 16: 30-34.

Worely, S., Jr.; Culp, T.W. and Harrell, D.C. (1974): The relative contribution of yield components to lint yield of Upland cotton, Gossypium hirstum. Euphytica. 23: 399-403.

THE RELATIVE CONTRIBUTION OF YIELD COMPONENTS TO LINT YIELD IN TWO COTTON GROUPS

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ABSTRACT

Kerr yield models for cotton were applied to two cotton groups to determine the relative contribution of various yield components to lint yield/square meter and lint yield/plant (LY/P). The first group included the four Egyptian cultivars Giza 80, Giza 66, Dendera and Giza 75. The second group included the two Upland cultivars Mcnaire 220 and Stoneville 213. Path coefficient results indicated that in both groups the number of bolls per square meter and number of boll per plant B/P were the main contributors to lint yield variations per unit area and per plant, respectively. Second in importance were seed per boll and lint per seed. The joint effect of charcters contributing to yield of lint as indirect effects were very small. Similarly, the residual effects were trivial in magnitude, indicating that the main biological units contributing to lint yield were included in the models. Thus, in conclusion selection to improve lint yield of cotton should be directed toward the prolificacy of B/m^2 or B/P and S/B or L/S in the breeding material.

INTROUDCTION

Attempts to simulate yield in cotton and yield components with geometrical models started with Manning (1956). Kerr (1966), expressed yield and yield components in geometrical models where otherwise ramifications of yield were fit in the models to increase their efficiency. Later on these models wer utilized by Bridge et al. (1971); Maner et al., (1971) and Worely et al., (1976). El-Shaer et al. (1975), in Egypt, applied these models on various populations of Eygptian cotton. Our objective here is to compare between two groups of cotton representing the Egyptian and Upland cottons with the aim to study associations of lint yield with various yield components in the two cotton groups and to estimate the relative contribution of each component to lint yield by using kerr models.

MATERIALS AND METHODS

The four Egyptian cotton cultivars, viz, Giza 80, Giza 66, Giza 75 and Dendera and the two Upland cultivars Mcnaire 220 and Stoneville 213 represented both groups in this study. Two experiments were established in the last week of march in 1981 and 1982 seasons. The six cultivars were planted at Giza Experimental Station. A randomized complete block design with six replications was used. Plots were five rows each. Each row was 4 m. long and 60 cm wide. Seeds were planted in hills 20 cm apart and hills were thinned to two plants six weeks after planting. Normal cultural practices were used during the two growing seasons.

Seedcotton yield (SCY) in kentar/feddan and in g./plant, boll weight B/wt. (g.), lint percent (L%), seed index (SI) (g/100 seed) were estimated from 120-plants samples representing each cultivar. These estimates were used to derive other yield components as follows:

LY= SCY/L%
(B/P)= SCY/B wt.
(B/m^2)= (SCY/m^2)/B wt.
(S/B)= B(100-L%)/SI.
(L/S)= B(L%)/(S/B)
(F/S)= (L/S)(ML) x Mic

Fiber properties were determined on sound boll samples, whereas seed cotton yield included in addition damaged and partially damaged bolls. All fiber determinations were run at the laboratories of cotton Technological Research Division, Cotton Research Institute, Giza.

The models:
Kerr's models used are the following:

Model I.(a) (LY/m^2= B/m^2 x S/B x L/S
I.(b) (LY/P)= B/p x S/B x L/S

Model II.(a) (LY/m^2= B/m^2 x S/B x Fs x Ml x Mic.
II.(b) (LY/P)= B/p x S/B x Fs x Ml x Mic.

Statistical analysis:
Correlation coefficients of LY/m^2 or LY/P with various lint components were estimated for various individual varieties. Correlation coefficients were averaged by using the appropriate transformation to establish an average value for each pair of traits in each group. Average simple correlation coefficients were partitioned into direct and

indirect effects by using path coefficient analysis. The net effect of yield components and the joint effects on lint yield were estimated by stepwise correlation analysis (Worley et al., 1976). All data were transformed to logarithms for the regression analysis because the yield model is multiplicative and the regression model is additive. This procedure computes a series of partial correlation coefficient. It is expected that the multiple correlation coefficient for each model equals unity if correct biological entities are included in the model.

RESUTLS AND DISCUSSION

Simple correlation coefficients of (LY) with various lint components for the two groups of cotton are shown in Table 1 and 2. Data show strong positive association between LY/m^2, B/m^2, S/B and L/S. With the Egyptian group as data suggest, increasing S/B may result in decreasing F/S and increasing the latter would be disavantageous at the expense of impairing both ML and mic. Henceforth increasing F/s may not be the best way to increase LY/m^2. In case of the Upland group the opposite is true, that is, increasing LY/m^2 would be achievable through F/S. Our findings on this point agree with those reported by Worley et al., (1976).

From Table (2), it is also evident that positive and strong correlation could be detected between LY/P and each of B/P, S/B and L/S in both groups. Again, improving LY/P through increasing F/S may be a formidable task in Egyptian cotton due to the negative associations of F/S and each of mic and ML. and this could be better done via L/s. With Upland group, still increasing LY/P could be achieved through S/B.

The relative contribution of various lint components to lint yield for both cotton groups as derived from path coefficient analysis for Model I(a) and Model I(b) are shown in Table (3). Evidently, B/m^2 was the major contributor to LY/m^2 as to Model I(a). The second contributor to LY/m^2 was S/B followed by L/S. The direct effect of B/m^2 was similar in both groups. Results of the regression analysis showed that the joint effect of B/m^2 x S/B, and S/B x L/S were minor as indirect effects through B/m^2.

As for Model I(b), it is also evident that B/P had greatest impact on LY followed by S/B and L/S in both cotton groups. The joint effect of B/P x S/B, B/P x L/S and S/B x L/S were of small magnitude Table (4).

Table (1): Correlation coefficients of Ly/m^2 and Ly components for four Egyptian and two Upland cotton varieties, 1981 and 1982 seasons.

Character	LY/m²	B/m²	S/B	L/S	F/S	ML	Mic	
	*	0.9554**	0.3704**	0.3908**	0.1462	-0.0102	0.2422*	LY/m²
B/m²	0.9450**	*	0.1251	0.2145*	0.2146	-0.0539	0.1698	B/m²
S/B	0.3804**	0.1125	*	0.0986	-0.2444*	0.0845	0.4264*	S/B
L/S	0.5228**	0.2668	0.2015	*		0.3119*	0.0661**	L/S
F/S	0.2713	0.1161	0.2093		*	-0.3964**	-0.4529**	F/S
ML	0.0045	0.1603	0.0672	-0.5309**	-0.4939**	*	-0.1127	ML
Mic.	0.2661	0.1698	0.1325	0.6911**	-0.4925**	0.0132	*	Mic

Above diagnoal coefficient are for Egyptian varieties and below diagnoal are for Upland varieties.

*, **: Significant at the 5% and 1%, respectively.